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ABSTRACT

This monograph traces the history of videodisc technology, describes the videodisc and its functions, reviews classroom applications and limitations, and discusses the future use of videodisc technology in elementary and secondary language arts classes. Two videodisc formats are discussed--constant linear velocity (CLV), and constant angular velocity (CAV). Five levels of interactivity in interactive video technology are outlined, and the capabilities and applications to education are presented for each level. The section on videodisc technology identifies various educational uses for the videodisc, including drill and practice, tutorial, and simulation activities. The monograph also considers the advantages of using the videodisc in comparison with 16-mm film and videotapes, and its effectiveness in teaching science, math, AIDS education, and social skills to handicapped children is also noted. Several projects employing videodisc technology are examined, including the Media Development Project for the Hearing Impaired (MDHPI), Interactive Videodiscs in Special Education Technology (IVSET), and Principle of the Alphabet Literacy System (PALS). A list of over-the-counter videodisc films is cited for use in language arts classes. (Figures of the levels of interactivity with applications to education, response of proponents of videodisc technology to public educators' concerns, and interactive videodiscs in language arts are included, and 69 references are appended.) (MM)

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APPLICATIONS OF VIDEODISC TECHNOLOGY TO LANGUAGE ARTS, GRADES K-12: A REVIEW OF THE LITERATURE

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by
Martina E. Lewis
April 1988

(Prepared as an outgrowth of presentation at NCTE in Los Angeles, CA, November 1987, as part of Assembly on Computers in English panel. Title of presentation: "Videodiscs: The Future in Education.")

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What is the size of an LP phonograph record, can store 54,000 slides on each side, can access any frame within three seconds or less, can display a single frame on a screen indefinitely without loss of resolution, and can combine the most useful features of computers and videotapes? The answer is a videodisc.

This monograph traces the history of videodisc technology; describes the videodisc and its functions; reviews classroom applications and limitations; reviews language arts programs and the future use of videodisc technology in elementary and secondary language arts classes.

HISTORY OF VIDEODISC TECHNOLOGY

Jarvis (1984) sees the modern videodisc as a hybrid, the result of crossing a number of technologies. Jarvis traces its history to Germany in the early 1880s, when Paul Gipkow received the first videodisc patents. At about the same time, Alexander Graham Bell produced optically recorded 12-inch audiodiscs, which he licensed to Thomas Edison, who introduced wax-cylinder audio players. Marketing of these was short-lived, however, because they were quickly replaced by 12-inch audiodiscs developed by Deutsche Grammophone. Later, Edison, through his Westrex company, developed talking movies, matching the running length of a reel of movie film to a 12-inch audiodisc spun at 33 1/3 rpm's.

In the 1920s, England's John Logie Baird developed a 12-inch pressed-wax audiodisc containing video test signals used for adjustments, a technology which the BBC used, but soon replaced by introducing an electronic scanning television system.

In the 1940s, Ampex Corporation developed magnetic-tape audio recorders and later videotape recorders, while Westrex developed the first stereo records.

Jarvis notes that the first working videodisc player was funded by 3M in the early 1960s. Using a silver-halide media read optically with a lightbulb illuminating source, there was at first substantial interference noise from adjacent video tracks. Because there is very little difference between consecutive movie frames, as long as people or things are not in motion, 3M reasoned that image noise would seem reduced by spinning a videodisc at an even number of frames per revolution. When 3M patented this in the early 1960s, videodiscs were immediately seen as a potential video-image storage peripheral for computers.

VIDEODISC AND ITS FUNCTIONS

The laser videodisc system is an optical system which reads light reflected from the disc. Digital information recorded on the disc is read by a laser beam located inside a laserdisc player. Hofmeister, Engelman & Carnine (1986) describe the process: "A low-power

laser beam in the player is directed onto the disc surface, where it either strikes a tiny pit or the more reflective surface between the billions of pits etched in the surface. The laser light is then reflected off the surface to a sensor, which detects these variations in density." They are then transformed into a signal that is fed to a television receiver.

Virtually every article reviewed includes either a brief or extended description of the videodisc and explanation of its functions. Because there are no inconsistencies in the information, the following is an encapsulation of the features of the videodisc (often referred to as a laserdisc) as described in the many articles.

A videodisc is a thin aluminum sheet contained in a protective shell of clear plastic the size and shape of a 33 1/3 vinyl phonograph record (popularly called an LP). Because the disc is encased in thick, clear plastic, it can be handled without damaging the quality of the recorded information. It can be touched, scratched, dropped, and soiled without destroying the recorded signal. There is virtually no wear on the disc when it is played because only a beam of light comes in contact with it. The disc is not indestructible, but with reasonable care, it will last indefinitely.

There are two formats of videodiscs: CLV and CAV. CLV (constant linear velocity) means that the disc

changes speed as it revolves, depending on the information that is being read. CLV discs can play up to 60 minutes of video on each side. CAV (constant angular velocity) means that the disc spins at 1800 revolutions per minute. At this speed, one revolution can display one frame of video information on a television screen (or monitor) and can continue to do so indefinitely, a capability that is called "freeze frame" or "still frame." Each side of a CAV disc can hold 30 minutes of running (real) time, which equals 54,000 separate visual motion and still images.

A 54,000-frame storage capacity is equal to 675 slide carrousels, each holding 80 slides. Because a videodisc is read by a beam of light not restricted to linear movement, any single frame can be accessed to the screen in a matter of not more than three seconds simply by entering the desired frame number on a keypad. Additional functions of a keypad that are usually standard are fast forward and reverse, slow motion forward, and step-frame (forwarding one frame at a time).

Because the CAV disc records one frame per revolution, there is no reduction in the quality of an image displayed in a still-frame mode. Theoretically, a frame could be left on a screen indefinitely, without loss of resolution. The quality of the image appearing

on the screen will remain the same quality of the image that was encoded onto the videodisc.

A CAV videodisc can be linked to a microcomputer, allowing a user to interact with the system. This is not possible with the CLV format because of the variation in revolution speed. In other words, still-framing is necessary for interactivity. When linked to a computer, the applicable term for the technology is "interactive video."

Levels of interactivity

Interactive video technology is recognized as involving five "levels of interactivity" (Hofmeister, Engelman, & others, 1986; Hofmeister & Thorkildsen, 1987; Manning, 1983; Nebraska Interactive Video, Inc., 1987; Schwartz, 1987). See Figure 1 for a differentiation between various levels and general applications of each level to education.

Figure 1

Levels of Interactivity
with Applications to Education

	Level 0	Level 1	Level 2	Level 3	Level 4
Capabilities	linear player only	freeze frames picture stops scanning chapter search dual audio speakers limited random access small hand remote controller	freeze frames picture stops scanning chapter search dual audio speakers rapid random access built-in microprocessor simple scorekeeping	freeze frames picture stops scanning chapter search dual audio speakers rapid random access external computer scorekeeping touch screen light pen	Sometimes refer-to as "custom". Not yet clearly defined. Applications would require specialized hardware rather than off-the-shelf equipment
Applications to Education	Same instructional applications as videotape players and movie projectors	Single frame can be used as quiz, which viewer can immediately review	Presents section of program, stopping at specified frame, permitting user to choose next section of program	Disc content organized at several levels of comprehension. Sytem guides user thru program at appropriate level. Can generate graphs and textual information. Can keep detailed record of progress	Custom applications

VIDEODISC TECHNOLOGY IN THE CLASSROOM

Although the videodisc has been in use as an educational tool for over ten years, its major applications have been in industry and the military. However, its potential range of use in the classroom has often been recognized (Bork, 1987; Brandt, 1986; Buterbaugh, 1980; Daynes, 1976; DeBloois et al., 1984; Dickson, 1986; Dworkin, 1986; Grabowski & Aggen, 1984; Helgerson, 1987; Hofmeister, Engelman, & Carnine, 1986; LeRoy, 1984; Leveridge, 1979; Manning et al., 1983; Neff, 1987; Reed & Sautter, 1986; Reigeluth & Garfield, 1984; Troutner, 1987; VanHorn, 1987). Interactive video is especially effective because people learn more through sight than all the senses, and the instant feedback intensifies the learning process by reinforcing each step of the lesson (Neff, 1987). Some experts in videodisc technology consider interactive videodisc systems to be the biggest breakthrough in instructional technology since the Gutenberg press (Reigeluth & Garfield, 1984).

Grabowski and Aggen (1984) write that the computer is the key to interactive video as an education tool: the videodisc provides the computer with an audio and visual library of resources, and serves as a data storage device. They identify three types of CBIV (computer-based interactive video) courseware: drill and practice, tutorial, and simulation.

Grabowski and Aggen caution designers of any computer-based instruction to heed research findings on how a learner processes information. The computer, especially when coupled with the videodisc, can effectively incorporate existing knowledge of several important concepts about internal cognitive processes:

> Memory consists of a sensory area, short-term storage, and long-term storage.
>
> The learner must actively process information in order for it to be shifted first from sensory to short-term memory and again to long-term memory.
>
> The memory consists of an extensive networking of prior knowledge.
>
> For more permanent learning to take place, these existing networks need to be tapped.
>
> For deeper information processing, new networks need to be formed from old ones through analytical thought.

Following these concepts, instructional designers of courseware can organize and present information in a way that engages the student as an active partner in the learning process in moving from the sensory store to the long-term memory.

In an extensive review of the curricular domain of the interactive videodisc, Helsel (1987) writes that a translation of curriculum theory into practical terms is necessary to give a sense of relationship to all the factors involved in a curriculum. Interactive videodisc planners, users, and evaluators can use information from traditional curriculum theory to strengthen the power and effectiveness of the technology as a teaching and

learning tool. She disagrees with the claims of some that interactive videodisc is so sophisticated and different that it demands new curriculum theories.

Referring to Elliot Eisner's definition of curriculum as a series of planned events that are intended to have educational consequences for one or more students, Helsel concludes that this is a definition that could certainly fit an educational interactive videodisc program. She recommends that interactive videodisc professionals consider utilizing Eisner's paradigm, which identifies fives patterns ordering the field of curriculum: 1) development of cognitive processes, 2) curriculum as technology, 3) curriculum as personal relevance, 4) social relevance, and 5) academic rationalism. These patterns are reviewed in the context of interactive videodisc applications.

While Helsel concludes that curriculum theory can indeed provide information to the educational videodisc profession, she cautions that much thought needs to be devoted to the implementation of curriculum theory to education interactive videodisc, and that specific research will have to be conducted to determine the best way to facilitate the implementation of videodisc curriculum into the public school system of this country.

Additional advantages of the videodisc

In addition to articles on videodisc technology as being pedagogically sound, several authors have listed advantages of choosing the videodisc over other audio-visual technologies.

Advantages of videodisc over 16-mm film are many (VanHorn, 1987). The videodisc is easy to play; it lasts indefinitely; it never needs rewinding; because the players aren't mechanical, they typically operate more than 4,000 hours before needing maintenance; the cost of a videodisc player and monitor is about the same as a 16-mm projector; and the cost of a videodisc (with no interactive capabilities) is about 10% of the cost of a film. Some disadvantages of film are that leaders break; sprocket holes tear; projectors often need maintenance and are mechanically unreliable; life expectancy of film is short, especially under heavy school use; and the cost of a 16-mm film can range from $250 to $700.

Advantages of videodisc over videotape are also many, as reported in T.H.E. Journal 1986-1987 Source Guide of High-Technology Products for Education (1986-1987). The videodisc is more versatile, being able to store more types of visual information than can videotape. Individual frames can be called up instantly and frozen for self-paced learning or review. Because a laser beam reads a videodisc without touching it, the quality of the image lasts indefinitely and the

videodiscs are extremely durable. When interfaced with a computer, videodiscs can be controlled from the keyboard and combined with diskette-based courseware. Videodiscs are patient teachers, able to explain correct answers again and again. Troutner (1987) emphasizes that most of the VCRs currently available in the schools cannot operate interactively. She also emphasizes the ease of access of information on a videodisc. Any designated frame on a videodisc can appear on the screen with speed and precision because of its random access capability, while on a videotape information can only be accessed in a linear fashion, which can be frustrating, inaccurate, and time-consuming.

LIMITED CLASSROOM USE

Despite the fact that videodisc technology has been available for almost ten years, its use in public schools has been very limited. When something this exciting and revolutionary comes along, it is difficult to believe that so many teachers, administrators, and librarians can so totally ignore it (Van Horn, 1987).

Some of those who have not ignored videodisc technology have experessed concerns, as shown in Figure 2 (Hofmeister & Thorkildsen, 1987; Van Horn, 1987).

Figure 2

Response of Proponents of Videodisc Technology
to Public Educators' Concerns Regarding
Use of Videodisc Technology in the Classroom

Concern	Response
Videodisc hardware is too expensive.	Each year the cost of hardware is lower. Most schools have monitors and computers in place that can be interfaced with a videodisc player.
Not enough software is available to warrant purchasing videodisc hardware.	While this was earlier the case, there are currently many generic discs available in various subject areas. In addition, there are well over 2,500 popularly available discs, many of them having educational value. The number of available discs increases monthly.
Dis players are just exotic machines that would be difficult to maintain.	Most disc players have a 5,000-hour "mean time before failure" and are easily repaired.
Just when most schools were equipped with VCR's, now we find out we need a videodisc player.	Purchasing a player and a few discs to evaluate its potential would be a wise course. A videodisc player can take its place alongside the VCR, both being valuable teaching tools.
We don't know that videodiscs have educational value.	It is true that, although studies have indicated that videodisc technology has successful applications, research is scarce. Hopefully, more studies will be conducted in the near future.
Videodisc can't be used to record.	Innovations appearing on the market such as HyperCard allow easy programming of generic discs.

Statistical evidence indicates positive effects of videodisc technology in social skills for handicapped children (Thorkildsen, 1985); science (Dworkin, 1986; Olsen, 1987; Smith & Andrews, 1985; Troutner, 1987); math (Dworkin, 1986; Troutner, 1987); and AIDS education (Bloom, 1987). Several interactive video programs are available in language arts but only a few have been field tested or have been involved in experimental studies (Bogyo & Fernback, 1985; Brawley & Peterson, 1983; Propp, Nugent, & Stone, 1980; Thorkildsen & Friedman, 1986). Figure 3 lists interactive videodiscs in language arts, followed by additional information about each of the programs.

Figure 3

Interactive Videodiscs in
Language Arts

Program	Reference	Program Description
Media Development for the Hearing Impaired (MDPHI) Videodisc Project	Developed at the University of Nebraska (Propp, Nugent, & Stone, 1980).	Series of discs to aid hearing impaired students in language development.
Interactive Videodiscs Project at the California School for the Deaf in Riverside (CSDR)	Developed at CSDR (Brawley & Peterson, 1983).	Level 3. Language and reading skills. Hearing impaired students. Elementary and secondary.
Custom program	Developed by reading specialists at Starpoint Central School in Lockport, NY (Bogyo & Fernback, 1985).	Level 3. Reading lab. Junior high remedial reading students.
Beginning Sight Reading Videodisc (BSR)	Developed by research team at Utah State University (Thorkildsen & Friedman, 1986).	Level 3. Reading remediation. Handicapped learners.
PALS (Principle of the Alphabet Literacy System)	IBM InfoWindow program. Contact: Media Learning Systems, 120 W. Colorado, Pasadena, CA 91105	Level 3. Literacy program for students reading below 5th grade.
Laser Learning discs	Hoffman Educational Systems 1720 Flower Ave. Duarte, CA 91010	Level 3. Reading comprehension. Upper elementary and junior high.
Earth & Space	Developed at Media Learning Systems, 120 W. Colorado, Pasadena, CA 91105 IBM InfoWindow program	Level 3. Development of written and verbal English comprehension and fluency. ESL (English as a Second Language) and LEP (Limited English Proficiency) students in junior and senior high.

MDPHI Videodisc Project

The Media Development Project for the Hearing Impaired (MDPHI) at the University of Nebraska designed videodiscs to meet the educational needs of deaf students (Nugent & Stone, 1982; Propp, Nugent, & Stone, 1980). Field testing indicated that the programs prompted student involvement and positive response (Nugent & Stone, 1982).

CSDR Videodisc Project

The California School for the Deaf at Riverside (CSDR) developed an interactive computer-videodisc system for the teaching of language and reading skills to hearing-impaired students. The project was undertaken in the late 1970s and the first phase of field-testing was begun in 1981. It was concluded that videodisc technology appears to be an effective instructional tool and that the students found the system to be motivating (Brawley & Peterson, 1983).

Starpoint Project

Using the History Disquiz, a Level 1 disc that contains forty-seven film clips of historic events and people, a group of teachers reported increased interest in reading among approximately 100 students in a remedial reading junior high school (Bogyo & Fernbach, 1985). The videodisc provided the content for vocabulary lists and study guides developed by the teachers. The

class competed in teams to find correct answers to the questions asked on the History Disquiz videodisc.

Using LaserWrite, the teachers then wrote computer programs for other videodiscs. Their conclusion was that positive gains were realized from using videodisc technology with junior high school remedial reading students.

IVSET Videodisc Project

In the late 1970s a research team at Utah State University undertook a project titled Interactive Videodiscs in Special Education Technology (IVSET). The purpose of the project was to develop a series of videodiscs that would investigate the instructional potential of using videodisc technology to teach reading to handicapped learners. Although the data indicated that the students learned the material presented on the videodiscs, the researchers emphasized the need for further research (Thorkildsen & Friedman, 1986).

PALS

Principle of the Alphabet Literacy System is an interactive instructional program designed to teach reading and writing to adolescents and adults who read below the sixth-grade level. A field-test of PALS at Cardoza High School in Washington, D.C., indicated an average growth of 27.7 months in reading ability over a four-month period (Magel, 1987).

Laser Learning series

The LaserDisc series of videodiscs is a multi-disc program that teaches reading comprehension skills. Favorable reports have come from Fort Miller Middle School in Fresno, California. The Detroit Public Schools are making extensive use of the series and report that it allows students to work at individual interest level, as well as particular reading level. Also found was that audio cuing and excellent language models of the narrators make Laser Learning appropriate for ESL programs (Pioneer Electronics, 1987).

Earth and Space Series

Earth and Space is a content-based English language instruction program for ESL and LEP learners. It is designed to help them acquire and develop written and verbal English comprehension and fluency, and to foster students' confidence in their ability to succeed in academic subjects (IBM InfoWindow Courseware Catalog, 1988).

Over-the-Counter Videodiscs

Hundreds of videodiscs are available in stores throughout the country. Prices range from about $30 to $100, depending on the capabilities of the disc. Some of the videodisc films have two audiotracks. One track allows for the sound track of the film; the second carries various kinds of information regarding the making of the film and comments on the story line.

A selection of some films available on videodisc and useful for language arts classes follows:

Adventures of the Little Prince (animation)
Adventures of Mark Twain (Claymation)
Bang the Drum Slowly
Citizen Kane
Clash of the Titans
Macbeth
The Magnificent Ambersons
The Red Balloon
Taming of the Shrew
To Kill a Mockingbird
12 Angry Men

In addition to films, videodiscs such as the National Gallery of Art and the Knowledge Disc (Grolier's Encyclopedia) are available in retail stores.

THE FUTURE OF VIDEODISC TECHNOLOGY IN LANGUAGE ARTS

Visual database videodiscs lend themselves to language arts instruction. In a pilot test with a small number of elementary school children in the use of a visual data base videodisc, W. Patrick Dickson (1986) observed that the students demonstrated enthusiasm over the almost unlimited number of pictures they could look at and choose from. The variety of pictures seemed to lead to whimsical, creative stories. Dickson noted that the augmentation of the word processor with images of the kind available on videodiscs helped create a highly stimulating writing environment. Also, a teacher or student could create a "slide show" out of images selected from the disc. As pointed out by Dickson, a videodisc includes an extraordinary number of images that can be reordered and intermingled for various

purposes. The images also do not become disordered with use, as might occur in sorting 35-mm. slides.

Generic videodiscs are being developed that classroom teachers can use to generate lessons to fit their specific day-to-day needs. For example, they can write text descriptions or questions over the video images, or they can program tests at varyious locations on the disc, using an authoring program called Laserwrite (T.H.E. Journal Source Guide, 1986/1987).

One of the most recent developments in the field of videodisc technology is HyperCard ($40). This software might revolutionize the availability of videodisc technology to the classroom teacher (Goodman, 1987). Designed for the MAC-SE or MAC-Plus computer, it can be interfaced to a videodisc player, and with a relatively user friendly authoring system can facilitate instant "production" of a videodisc that includes a programmed text.

Robert Neff (1987) in a review of the future of interactive video in public education states that most observers think the pace will pick up substantially now that IBM and NCR are becoming more involved in the education market. On the other hand, Van Horn (1987) states that "perhaps the [videodisc] technology is still 'too new' for educators to embrace it enthusiastically." Hofmeister & Thorkildsen (1987) suggest that the public school system will probably not accept the technology

until videodisc-based instructional products are specifically designed to meet the needs, restrictions, and strengths of public school instruction.

The value of interactive instruction is emerging from current research (Troutner, 1987), but there is a need for more research in the efficacy of using videodisc technology in public school education (Hofmeister & Thorkildsen, 1987).

Whether or not videodisc technology will indeed find its place in the public school system remains to be seen. In the words of Robert Neff (1987): "With many Americans relating to TV screens at least as well as they do to other humans, interactive video may sweep classrooms much faster than computers. It makes one-on-one training economical--and can bring the best instructors face-to-face with any student who has access to an interative video system."

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